In the Claims

Claims 18-35 have been withdrawn

Claims 1 and 10 have been amended

1. (currently amended) An apparatus for performing laser thermal annealing of a substrate having a surface, comprising:

a laser capable of generating continuous annealing radiation having a wavelength that is not substantially absorbed by the substrate at room temperature;

an annealing optical system adapted to receive the annealing radiation and form an annealing radiation beam that forms a first image at the substrate surface, and wherein the first image is scanned across the substrate surface; and

a heating device for heating at least a portion of the substrate to a critical temperature such that the annealing radiation beam incident upon said portion is substantially absorbed near the surface of the substrate at said portion during scanning;

wherein the heating device includes:

a preheating radiation source adapted to emit preheating radiation of a wavelength that is substantially absorbed by the substrate at room temperature; and

a relay system adapted to receive the preheating radiation from the preheating radiation source and form a preheating radiation beam that forms and scans a second image over the substrate surface to preheat a portion of the substrate that is in front of or that partially overlaps the scanned first image.

2. (original) The apparatus of claim 1, wherein the annealing radiation beam wavelength is greater than 1μm.

3. (original) The apparatus of claim 1, wherein the substrate is supported

by a movable stage adapted to achieve said scanning by moving the substrate relative to the annealing radiation beam.

4. (original) The apparatus of claim 1, wherein the annealing radiation has a wavelength of 10.6 μm.

5. (original) The apparatus of claim 1 wherein the substrate is undoped or lightly doped silicon.

6. (original) The apparatus of claim 1, wherein the first image formed by the annealing radiation is a line image.

7. (original) The apparatus of claim 1, wherein the heating device includes a heated chuck adapted to support and heat the substrate to the critical temperature.

8. (original) The apparatus of claim 7, wherein the heating device further includes a heat shield that reflects heat emitted from the substrate back to the substrate.

9. (original) The apparatus of claim 1, where the heating device includes a heated enclosure adapted to surround the substrate and to heat the substrate to the critical temperature.

10. (currently amended) The apparatus of claim 1, wherein the ~~**heating device**~~ **relay system** includes:

~~**a preheating radiation source adapted to emit preheating radiation; and**~~

a relay lens ~~**adapted to receive the preheating radiation and form a**~~

~~preheating radiation beam that forms a second image at the substrate, wherein the second image is scanned over the substrate surface to preheat a portion of the substrate that is in front of or that partially overlaps the scanned first image; and~~

~~wherein the preheating radiation has a wavelength that is substantially absorbed by the substrate at room temperature~~.

11. (original) The apparatus of claim 10, wherein the second image is a line image.

12. (original) The apparatus of claim 10, wherein the preheating radiation beam has a wavelength of 780nm or 800nm.

13. (original) The apparatus of claim 10:

wherein the relay lens is arranged such that the preheating radiation beam is incident on the substrate at normal incidence; and

further includes:

a polarizer; and

a quarter-wave plate;

wherein the polarizer and quarter-wave plate are arranged in the preheating radiation beam to reduce an amount of preheating radiation reflected from the substrate from reaching the preheating radiation source.

14. (original) The apparatus of claim 10, wherein a polarizer and a Faraday rotator are arranged in the preheating radiation beam to substantially prevent preheating radiation from returning to the preheating radiation source.

15. (original) The apparatus of claim 10, wherein:

the preheating radiation source is an array of laser diodes; and

the relay lens is anamorphic and forms the second image as a line image of the array of laser diodes at the substrate.

16. (original) The apparatus of claim 10, wherein the relay lens includes elements that are adjustable to maintain the second image in focus.

17. (original) The apparatus of claim 1, further including:

a chuck that supports the substrate;

a movable stage that supports the chuck; and

a stage driver operatively connected to the movable stage to selectively move the stage to selectively move the substrate to effectuate said scanning.

18. (withdrawn) A method of laser thermal annealing a substrate, comprising:

providing an annealing radiation beam from a laser having a wavelength that at room temperature is not substantially absorbed by the substrate;

heating at least a portion of the substrate to a critical temperature such that the annealing radiation beam is capable of being substantially absorbed near the surface of the substrate at said heated portion; and

initiating a self-sustaining annealing condition by scanning the annealing radiation beam over the heated portion of the substrate.

19. (withdrawn) The method of claim 18, wherein the substrate is an undoped or lightly doped silicon substrate.

20. (withdrawn) The method of claim 18, wherein said heating includes providing heat to the substrate via a heated chuck that supports the substrate.

21. (withdrawn) The method of claim 20, including reflecting heat radiated from the substrate back to the substrate.

22. (withdrawn) The method of claim 18, wherein said heating includes providing heat to the substrate via a heated enclosure that surrounds the substrate.

23. (withdrawn) The method of claim 18, wherein said heating includes irradiating the portion of the substrate with a preheating radiation beam having a wavelength that is substantially absorbed by the substrate at room temperature.

24. (withdrawn) The method of claim 23, wherein the preheating radiation beam wavelength is 780nm or 800nm.

25. (withdrawn) The method of claim 23, including generating the preheating radiation beam using an array of diode lasers.

26. (withdrawn) The method of claim 23, wherein the annealing radiation beam forms a first image at the substrate, the preheating radiation beam forms a second image at the substrate in front of or partially overlapping the first image, and wherein the first and second images are scanned over the substrate.

27. (withdrawn) The method of claim 26, wherein the second image is maintained in front of or partially overlapping the first image during scanning.

28. (withdrawn) The method of claim 18, wherein the annealing radiation beam has a wavelength of greater than 1μm

29. (withdrawn) The method of claim 28, wherein the annealing radiation beam has a wavelength of 10.6μm.

30. (withdrawn) The method of claim 23, including:

empirically determining at least one of i) a critical temperature produced by the preheating radiation beam to initiate a self-sustaining annealing condition, and ii) a minimum power required in the preheating radiation beam to initiate the self-sustaining annealing condition by irradiating a set of test substrates with a corresponding set of annealing radiation beams and a set of preheating radiation beams having select intensities.

31. (withdrawn) The method of claim 18, wherein the critical temperature is 360°C or greater.

32. (withdrawn) The method of claim 26, wherein the scanning is performed in a pattern selected from the group of patterns comprising: raster, boustrophedonic, and spiral.

33. (withdrawn) The method of claim 26, wherein the scanning is performed by selectively moving a movable substrate stage that supports a chuck that in turn supports the substrate.

34. (withdrawn) The method of claim 23, wherein the preheating radiation beam has a power level, and wherein the power level is set by:

scanning the substrate under an annealing radiation beam having sufficient power to anneal an absorbing substrate;

raising the power level of the preheating radiation beam until an annealing temperature is reached on the substrate surface; and

setting the power level to at least that which results in the annealing temperature being reached.

35. (withdrawn) A method of laser thermal annealing a substrate having a

temperature, comprising:

providing an annealing radiation beam from a laser having a wavelength that at room temperature is not substantially absorbed by the substrate;

irradiating a portion of the substrate with a scanning preheating radiation beam having a wavelength that is substantially absorbed by the substrate at room temperature so as to raise the substrate temperature to a critical temperature such that the annealing radiation beam is capable of being substantially absorbed near the surface of the substrate at said heated portion; and

initiating a self-sustaining annealing condition by scanning the annealing radiation beam behind of or partially overlapping with the preheating radiation beam.